

APPLICATION NO. 09/871,001
DOCKET NO. P1039B/N8515**REMARKS**

Claims 1-22 are pending in the above-captioned application. Claim 1 has been amended herein in order to more clearly define and fully protect Applicants' invention. Reconsideration and allowance of all claims 1-22 is respectfully requested.

Claim 1 has been amended herein in order to make it more explicate that the graphite intercalation compounds are present in the flexible graphite material in an amount sufficient to improve the thermal or electrical properties of the sheet. Support for this amendment appears in the specification at page 17, lines 7-10.

Prior Art Rejections

As in the prior Office Action, claims 1-10, 12-20 and 22 stand rejected under 35 U.S.C. §102(b) over Mercuri (U.S. 5,846,459); claims 1-2, 5-13, and 16-22 stand rejected under 35 U.S.C. §102(b) over Shane et al. (U.S. 3,404,061); claims 11 and 21 stand rejected under 35 U.S.C. §103(a) over Mercuri further in view of Mercuri et al. (U.S. 5,902,762). However, nothing in the cited patents anticipates or renders obvious the inventions of the rejected claims.

In each of the cited prior art references, raw graphite flake is exposed to graphite intercalants. The thus intercalated flake is then exposed to high temperatures in order to exfoliate the flake, and thereafter the exfoliated "worms" are compressed into flexible graphite sheet. It is important to note that the very process of exfoliation vaporizes the intercalants for, indeed, it is this vaporization which

APPLICATION NO. 09/871,001
DOCKET NO. P1039B/N8515

causes expansion of the graphite flake to form "worms". Thus, the intercalants do not remain in the flake after exposure to heat.

In the present invention, already formed graphite sheet is exposed to graphite intercalation compounds, which intercalate into the sheet and remain present. These graphite intercalation compounds, as taught, can provide different characteristics to the sheet than are observed by the standard preparation in which the intercalants vaporize. Indeed, as noted, many different intercalation compounds can be used in this post-sheeting intercalation including halogens, transition metals, etc. This difference between processing is especially clear from claim 12 which recites that the sheet of exfoliated graphite particles is intercalated rather than raw graphite itself, as in the cited references. Thus, the cited references cannot and do not anticipate the inventions of the rejected claims nor do they suggest intercalating an already formed sheet of flexible graphite.

The focus of the rejection of the claims of this application appears to be the contention in the Office Action that some intercalant must of necessity remain after exfoliation in the art-conventional flexible graphite synthesis method. As noted in the application, graphite reacts with a large number of acids to form intercalation compounds, including but not limited to nitric acid (HNO_3), sulfuric acid (H_2SO_4), perchloric acid (HClO_4), selenic acid (H_2SeO_4), etc. The acids act as electron acceptors in the graphite crystal by forming negatively charged radicals (NO_3^- , HSO_3^- , etc.). However, only a small fraction undergoes the ionization which draws the acid into the graphite lattice. The rest remain as acid molecules in the graphite

APPLICATION NO. 09/871,001
DOCKET NO. P1039B/N8515

crystal; it is these acid molecules that cause the exfoliation. The acid boiling points are 83, 338, 39, and they dissociate from the liquid at 260°C, respectively. The most stabile, sulfuric acid, has a half-dissociation temperature of 350°C. None of these compounds will exist at anywhere near the temperatures used to manufacture flexible graphite, nor will the radicals.

As to the comment in the Office Action that "at least, a little of non-neglectable intercalants do remain", the analogy can be drawn that within every measurable quantity of lead there exists gold. Alchemists have tried for the better part of a thousand years without success to make use of it. Similarly, the amount of intercalant remaining in flexible graphite after exfoliation is negligible. In any event, the graphite intercalation compounds present in the instant invention are specifically those which improve the thermal or electrical properties of the material, as compared with prior art flexible graphite materials. If any measure of intercalant remains in the graphite upon exfoliation to 80x expansion, it is also certainly of no use in changing the properties of thermal and electrical conductivity in the material in question and is therefore negligible.

Accordingly, none of claims 1-22 is anticipated or suggested by the cited references. Withdrawal of the rejections under 35 U.S.C. §102(b) and 35 U.S.C. §103(a) is therefore appropriate and requested.

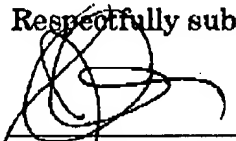
APPLICATION NO. 09/871,001
DOCKET NO. P1039B/N8515

CONCLUSION

Based on the foregoing amendments and remarks, it is believed all claims 1-22 are now in condition for allowance. Such action is earnestly sought. If there remains any matter which prevents the allowance of any of the pending claims, the Examiner is requested to call the undersigned, collect, at 615-242-2400 to arrange for an interview which may expedite prosecution.

Pursuant to 37 C.F.R. §1.136(a), Applicants petition the Commissioner to extend the time to respond to the December 5, 2003 Office Action for 1 month from March 5, 2004 to April 5, 2004. Applicants authorize the Commissioner to charge the \$110 fee amount to Deposit Account No. 50-1202. The Commissioner is authorized to charge any deficiency or credit any overpayment associated with the filing of this Response to Deposit Account No. 50-1202.

Respectfully submitted,



James R. Cartiglia
Registration No. 30,738
WADDEY & PATTERSON
A Professional Corporation
Customer No. 23456

ATTORNEY FOR APPLICANTS

Waddey & Patterson
414 Union Street, Suite 2020
Bank of America Plaza
Nashville, TN 37219
(615) 242-2400